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PREPARED IN THE OFFICE OF EXPERIMENT STATIONS.

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EXPERIMENT STATION WORK.

Edited by W. H. Beal and the Staff of the Experiment Station Record.

Experiment Station Work is a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief object of these publications is to disseminate throughout the country information regarding experiments at the different experiment stations, and thus to acquaint farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practice. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. True, Director, Office of Experiment Stations.

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ILLUSTRATIONS.

EXPERIMENT STATION WORK.[a]

IMPORTANCE OF PURE WATER FOR MILCH COWS.[b]

Typhoid fever has often been ascribed to a contaminated milk supply. As during the summer and fall when this disease prevails cows are frequently forced to get their drinking water from sloughs and stagnant ponds which may be contaminated with the germs of typhoid fever, it is important to know whether such germs find their way into the milk supply through the cow or by contamination of the milk after it is drawn from the cow. This matter has been the subject of very careful investigation by E. F. Pernot, of the Oregon Experiment Station, who administered various germs, including that which causes typhoid fever, to a cow and examined the milk and excreta obtained for the presence of the germs. It was found "(1) that a pure culture of typhoid bacilli mixed with water and given to the cow to drink did not pass into the milk; (2) that they did not pass from the cow alive with the excreta; and (3) that they did not pass from the cow alive with the urine. * * * Although the results in this experiment have been negative in transmitting the germs from polluted water to the milk supply through the cow, it does not follow that the danger from cows using such water does not exist."

As cows frequently stand in the water to escape flies or to cool themselves, and their udders may thus become contaminated with the polluted water, investigations were made to determine to what extent germs in this way enter the teats and contaminate the milk. "The cow used in this work was a Jersey about 4 years old, with fair-shaped udder, good teats of medium size, reasonably easy to milk." The teats were dipped in water containing the germs and allowed to dry naturally. After the lapse of several hours milk was drawn and examined for the germs, but none was found, showing "that they were not taken into the udder by capillary attraction through the teat orifice." * * *

There is no doubt that there is a great variation in the teats of different milch cows. A teat possessing weak sphincter muscles is imperfectly closed at its extremity and

[a] A progress record of experimental inquiries, published without assumption of responsibility by the Department for the correctness of the facts and conclusions reported by the stations.

[b] Compiled from Oregon Sta. Bul. 71 and Arizona Sta. Bul. 34.

must necessarily be more accessible for bacteria to enter through the duct and invade the contents of the udder, while another teat having good muscular contracting power would be less likely to admit germs. Yet it seems almost impossible that any moist muscular orifice could so contract as to shut out an organism of such minute dimensions, especially those like typhoid, which are actively motile.

It is generally believed that micro-organisms gain access to the milk in the cow's udder through the teat, but in this case they did not, although the result might not be the same with all cows.

Even if it should be proven that milk is not contaminated in this way the danger is not removed, because the body of a cow which has been wading in impure water is itself a source of contamination, since it is impossible to milk such a cow "without particles of material falling into the milk and carrying with it innumerable germs. This we know occurs to such an extent that it is customary to strain the milk to remove the particles of foreign matter. When a bacteriological study is made of this sediment the number and kinds of these germs found are truly surprising. If all the germs thus entering the milk would remain in the sediment it would be all right, but unfortunately, dropping into the milk with this foreign matter, the germs are liberated through constant agitation incident to milking. As warm milk is a very suitable material for germs to grow in, especially typhoid-fever germs, the number which would multiply in twelve hours from the few introduced at the time of milking would be enormous and dangerous." On this point R. H. Forbes, of the Arizona Station, says:

> When a cow wades belly deep into a filthy pool festering in the heat and fouled with excretions, her milk will inevitably suffer. Not only will the foul odors of the water she drinks be imparted in some measure to the milk, but millions of bacteria, adhering to her hair and udder, will, when she is dried off and milked, find their way as dust into the milk pail. Quick souring of milk in warm weather and undesirable changes in butter and cheese, caused by bacteria, result.

It would seem that these are sufficient reasons why cows should be prevented from having access to foul water, but there is the additional reason of danger to the health of the animal from disease germs which may be present.[a]

Although these are dangers that it is well worth while to guard against, it is evident, as Mr. Pernot points out, "that outbreaks of typhoid fever occur which, if the cause were carefully traced, would be found to come not from the milk as it leaves the cow, but from vessels which had been washed with contaminated water," and he calls attention to the fact that "since the advent of the cream separator, which is usually driven by steam power, steam has been used to clean all the utensils in the dairy. Not only is it efficient for this purpose, but as a germ destroyer there is nothing better, because it penetrates to the bottom of the seams and heats the metal to such a degree as to kill dangerous germs."

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[a] For a discussion of this phase of the subject, see U. S. Dept. Agr., Farmers' Bul. 97 (Experiment Station Work, X), p. 17.

WHEN TO CUT FORAGE CROPS.[a]

The proper stage of growth at which to cut forage crops grown for hay is a question which often arises. Several factors should be taken into account in considering this matter. Among the more important are the yield per acre, the proper drying or curing of the fodder, and the feeding value of the cured material. R. W. Thatcher recently studied this subject at the Nebraska Experiment Station with oats and field peas, field corn, millet, sorghum, Kafir corn, and cowpeas. It is stated that the season was favorable, and that all the crops had made a healthy growth. Before the crops were mature the first samples for analysis were taken, and the second three weeks later. Special care was exercised to secure representative samples in every case. The results of the analyses follow:

Composition of feeding stuffs at different stages of growth.

[On air-dry basis.]

Feeding stuffs.	Water.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Oats and peas:						
Pea pods beginning to form, oats beginning to head	12.67	16.19	2.90	30.24	28.15	9.85
Pea pods all filled out, oats in full bloom	11.32	16.27	2.40	35.99	25.41	8.88
Field corn:						
Tassels beginning to appear	13.03	8.08	1.37	40.43	27.09	10.00
Corn full grown, some ears formed	13.85	6.69	1.38	45.74	24.04	8.30
Millet:						
Heads just appearing	10.24	8.41	2.54	32.03	35.86	10.92
Headed out, seeds nearly ripe	10.47	6.12	1.52	43.33	29.10	9.41
Sorghum:						
Heads just appearing	13.50	8.65	2.97	34.56	30.62	9.70
Headed out, seeds beginning to form	11.23	6.27	1.90	41.69	30.05	8.86
Kafir corn:						
Heads just appearing	11.37	8.53	1.76	35.94	32.74	9.66
Headed out, seeds beginning to form	12.95	6.98	2.06	37.42	31.38	9.21
Cowpeas:						
Vines 16 inches high, no heads formed	11.76	19.77	2.70	28.64	21.68	15.45
Well developed, some pods formed	12.60	19.09	2.71	30.25	21.33	14.02

As pointed out by the author, chemical composition does not definitely settle the comparative value of different feeds. Wholesomeness, digestibility, and other factors must also be taken into account. It does, however, furnish a convenient basis for studying the comparative food value of different materials. From the analyses reported, the following general deductions were drawn:

The conditions of growth of the crops this season were about equally favorable for each of them, and some tentative conclusions may hence be drawn from the results of this season's work. * * * The mixed crop, oats and peas, improves in composition as it grows older and should probably be allowed to stand as long as the pea vines will remain fairly erect. The proportion of flesh-forming to fat-forming constituents in the fodder obtained from this crop is very nearly the correct one for a well-balanced ration for most classes of animals.

[a] Compiled from Nebraska Sta. Rpt. 1901, p. 73.

Field corn, millet, sorghum, and Kafir corn decrease rapidly in protein content while heading out. The percentage of crude fiber also decreases somewhat. Both of these changes are probably due to the rapid accumulation of starch and sugars in the plant juices at that time, as shown by the increased proportion of nitrogen-free extract. In order to obtain a fodder having as narrow a ratio of flesh-forming to fat-forming foods as possible, the crop should be cut at as early a stage as it can be well cured. For "roughage" to be fed in connection with highly nitrogenous foods, it may well be allowed to grow until seeds are formed. After that period, however, the stalks rapidly become woody and the proportion of waste is greatly increased.

No very significant change in composition of the cowpeas is apparent. This year's experience would seem to indicate that the consideration of chemical composition is of minor importance in the selection of the proper stage for harvesting this crop for fodder. As compared with the other fodders analyzed this year, this one is by far the most desirable, on account of its high proportion of nitrogenous material and small percentage of difficultly digestible fiber.

The composition of alfalfa hay at different stages of growth was discussed in an earlier bulletin of this series.[a]

LIPPIA, OR FOG-FRUIT, AS A LAWN PLANT AND SOIL BINDER FOR ARID REGIONS.[b]

The great value of a plant which will form a satisfactory sward and prove a successful soil binder under the conditions of the arid region will be readily admitted. The observations and experiments of the Arizona Station, supplementing experience in southern California, indicate that these requirements are met to a large extent by Lippia, or fog-fruit (*Lippia nodiflora*), a plant belonging to the same family as the lantanas and verbenas. The plant is found in tropical and subtropical regions and occurs in this country in the South Atlantic and Gulf States and from Texas to California, principally along sandy shores and water courses. It "is a perennial, herbaceous, much-branched, creeping plant, the stems of which root extensively at the nodes. The thickened opposite leaves are 1 inch long or less, mostly blunt at the tips, and rather sharply saw-toothed above. The roots become greatly thickened below during the autumn, and this reserve food supply undoubtedly enables the plant to begin growth in the spring with little or no rain, and also to maintain itself during long adverse periods." It has practically no value as a forage plant because it develops a relatively limited vegetative growth, and animals dislike it, but the observations of the Arizona Station indicate that it can maintain a continuous layer of green with less water than any other desirable plant known to that region. During the summer of 1902 it maintained itself for eight months on the mesa with less than 2 inches of rainfall. Not only is it a remarkable drought resister, but it can endure without injury extremes of temperature, varying from 10° to 110° F. It is, however, only slightly resistant to alkali, although it has been found to thrive in soils too alkaline for roses.

[a] U. S. Dept. Agr., Farmers' Bul. 105 (Experiment Station Work, XII).

[b] Compiled from Arizona Sta. Bul. 45; Rpt. 1902, p. 263.

The plant possesses special advantages as a sand and soil binder. "When set 2 feet apart in favorable situations, it was observed that well-rooted plants of the fog-fruit covered the surface completely during one season's growth; and there is every reason to believe that it will do equally well in moist, sandy washes, since it favors such locations."

It will doubtless prove equally valuable for preventing washing of reservoir and stormwater embankments.

As a lawn plant for regions in which the usual lawn grass is grown with great difficulty, if at all, Lippia seems to have peculiar advantages. It is easily grown and "forms a smooth carpet of green, interspersed with many small capitate flower clusters of rose-purple, varying to nearly white. In general, it gives all the effects of a white-clover lawn, though forming a more compact mass and not requiring the use of a lawn mower." It is not suited to densely shaded lawns and will not endure excessive trampling.

The plant is propagated by cuttings. The best time for planting is "during the spring or summer months, when, if well watered, it will be almost certain to secure a good start." The publication by the Arizona Station of information regarding this plant has aroused much local interest, resulting in a quite extensive distribution of plants by the station to persons wishing to try it.

PITHINESS IN CELERY.[a]

Some experiments recently reported by the Maryland Experiment Station would seem to indicate that one of the causes of pithiness in celery is insufficient attention to the selection of seed. The station reports that in 1900 40 per cent of the plants grown in an experimental plat at the station from American-grown seed was pithy, while not a single stalk grown from French-grown seed in another similar plat was pithy. The variety used in both cases was Golden Self-Blanching. The experiment was continued in 1901 and 1902 with seed obtained from several different American seed firms. The results obtained are shown in the following table:

Pithiness in celery grown from American and French seed.

Kind of seed.	Pithy stalks.	
	1901.	1902.
	Per cent.	*Per cent.*
A's French-grown seed	1	0
A's American-grown seed	43	46
B's French-grown seed	38	26
B's American-grown seed	40	43
C's French-grown seed	0	0
C's American-grown seed	.....	38
D's American-grown seed	31	.....
D's American select stock	.....	10
E's selected stock	20	.....

[a] Compiled from Maryland Sta. Bul. 83.

In the case of A's and C's seed the table clearly shows a great superiority as regards pithiness for the French-grown seed. B's French-grown seed appeared to be in no way different from his American-grown seed and was probably a mixed lot of seed, since in both seasons the stalks of the celery grown from this seed were neither uniform in color nor size. D's select stock of seed was American grown and had been carefully selected and cared for, thus indicating clearly that by care and selection the quality of American-grown celery seed can be greatly improved. The station's conclusions relative to this work are in part as follows:

Taking the various points into consideration, the experiments plainly show the superiority of French-grown seed over the American-grown. That the difference is not due to the character of the soil or to climatic conditions is apparent from the fact that the celery stalks from the French seed were entirely different, though they were grown under the same conditions of soil and climate and were given the same kind of care. The difference must have come from the seed. We can not accept as an established fact that the highest quality of celery seed can not be grown in America. But we can believe that the seed is not carefully selected and grown. Pithy stalks should never be used for seed, and seed plantations should be carefully watched and rogued whenever a strange plant appears. That much of the European-grown seed is superior to American-grown seed can not be disputed. The superiority is due altogether to their careful selection of seed stock and the subsequent attention paid to the plant to keep it up to the set standard. There can be no doubt that if the American celery-seed growers were as careful in their work as the French growers are their seed would in all probability be as good. Cheap seed is dear at any price. This is especially true when the profit of a whole season's work is dependent upon it.

IRRIGATION OF STRAWBERRIES.[a]

It is evident that there is a growing interest among farmers of the humid region in irrigation, especially as applied to market-garden crops, small fruits, and other high-value crops.[b] Among crops of this class the strawberry seems to be particularly well suited to test the profitableness of the practice, and has been made the subject of irrigation experiments by several of the stations.

The strawberry plant, especially at the time of fruiting, quickly suffers from an insufficient water supply. In many of the Northern States droughts are apt to occur at about the fruiting season. One thorough irrigation at the Wisconsin Station of a crop just beginning to ripen, and on which no rain had fallen for the preceding eighteen days, almost doubled the yield, although a rain occurred five days later. The fruit from the irrigated rows was much larger and its market value consequently much increased because of the irrigation. Unirrigated crops in the neighborhood were almost a failure. Other

[a] Compiled from Wisconsin Sta. Rpt. 1894, p. 332; Connecticut Storrs Sta. Rpt. 1896, pp. 235, 238; Colorado Sta. Buls. 29 and 53; Kansas Sta. Bul. 55; Georgia Sta. Bul. 32; New Jersey Stas. Rpts., 1900, p. 230; 1901, p. 233; Michigan Sta. Bul. 63.

[b] U. S. Dept. Agr., Farmers' Bul. 56 (Experiment Station Work, I), p. 17.

irrigations followed after the fruit was picked and a vigorous growth of vines was secured. A drought also occurred the following season, when the yield from the irrigated rows was more than nine times as great as from the nonirrigated rows. The experience of that season further showed that late-summer irrigation, no matter how beneficial in producing vigorous plants in the fall, is of no value unless supplemented by timely irrigation when the fruit is maturing.

In these experiments the water was distributed in the field through a series of V-shaped wooden troughs, made of inch boards set at right angles to each other (fig. 1). Cleats were nailed across the top, one at the center and one near the ends of each trough, to keep the boards from spreading. Two sizes of troughs were used, the larger being made of one 12-inch and one 10-inch board and the smaller of one 10-inch and one 8-inch board. The smaller troughs were used farthest away from the source of the water. The end of one trough set inside that of the next, and leakage at the unions was prevented by placing between the overlapping boards a strip of building paper or a little dirt. The troughs were supported in the field by straight crossed stakes. Each of the stakes had a row of small auger holes through its center, about 3 inches apart, so that by slipping an iron spike through the pair of stakes at the proper point the troughs were adjusted at the desired height. A tie strip was pinned across from one stake to the other, just at the surface of the ground, to prevent the bottoms from spreading or from settling too far in the ground, as they are sometimes inclined to do after the soil becomes wet.

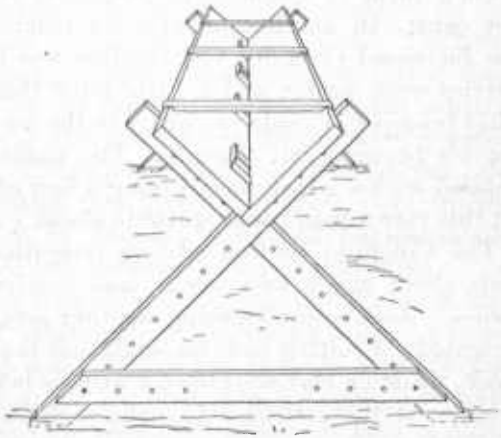

FIG. 1.—Support for irrigation trough.

Water was permitted to flow from the troughs through three-fourth inch auger holes spaced 3½ feet apart on one side, near the bottom of the trough. The flow of the water was controlled by a sliding gate of thin galvanized iron.

[The sliding gate] is made of two small pieces of thin galvanized iron. One has a three-fourths inch hole through it, half an inch from its lower edge, and the side edges are bent over, so that the other, which has its upper edge bent forward at a right angle to form a handle, may be slipped in and thus form a gate to shut off the hole more or less at will. This device is tacked with clout nails to the inside of the trough, so that the hole exactly coincides with the one through the board that forms the side of the trough. If the attendant discovers that one row of strawberries is receiving more than its share of water he partially closes the gate at the end of this row, and

if another row is receiving too little he opens its gate more. A sufficient length of trough should be used so that the holes can discharge all of the water delivered without being open to their full capacity.

From these troughs the water is allowed to fall in small streams and slowly flow along the shallow furrows on either side of the matted strawberry rows. The slowly flowing water permeates the mellow ground as it proceeds and soaks in among the roots of the plants without puddling the surface, but leaving it more porous and permeable to air than after a rain. An attendant directs the stream as it is needed while walking on dry ground. By this method of irrigation there is no undue packing of the soil and no puddling of any part of it. It has been found more satisfactory to apply the water slowly over a large area at once, giving it ample time to soak into the ground, than to apply it faster over a smaller area.

On a farm in Connecticut irrigation increased the total yield 177 per cent. In another experiment conducted under station auspices the increased yield due to irrigation was 155 per cent. The irrigated berries were larger and a little later than the nonirrigated berries. They brought 11 cents per quart in the market, while the nonirrigated berries brought but 9 cents. The water in these experiments was applied with a 2-inch hose, giving a flow of about 1 barrel per minute. At this rate a man could sprinkle about 1 acre in a day.

The Colorado Station advises irrigation of newly set strawberry beds about every two weeks, and cultivation continued until frost comes. Just before freezing weather sets in the plants should be well irrigated. Fruiting beds on sandy soil require irrigation about twice a week, while on clay soils once a week is believed to be sufficient. The practice at this station is to make a shallow furrow close to each row of plants as soon as they are set and run water down the furrows at once, even though the soil be moist. This settles the soil about the roots of the plants and gives them a prompt, vigorous start. The water should be confined to the furrows and not allowed to flood the rows. At this station, also, a small stream allowed to flow for a long time is considered better than a more rapid supply. If a lateral is made across the ends of the rows and the water supplied to each furrow through a short piece of 1-inch pipe embedded in the bank of the lateral, a constant uniform flow will be secured. This method is considered safer and easier than breaking the bank of the lateral for each furrow, especially on soils inclined to wash.

The Kansas Station thus describes a method which it has followed in irrigating strawberries:

We sometimes turn the hose into the furrows running along the rows of plants, but when they are in full leaf and maturing the fruit we have found that a given quantity of water is worth much more when showered directly onto the matted rows than when run down the spaces between the rows and allowed to soak out laterally

to reach the plants. A thorough showering is worth more than the same water used in several light applications. This work should always be done in the afternoon and evening, and in special stress at ripening time we have kept the hose going half of the night. This is much better for the plants than to put the water on during the heat of the day under a clear sky and with a dry wind blowing.

The Georgia Station states that irrigation can not be recommended for general practice in that State on a large scale. It seems to make the berries soft and unfit for market in that section, and the berries soon decay. The flooding of the ground makes it muddy and disagreeable for pickers, and it is advised that if practiced it should be applied only to limited areas and in special localities. Irrigation in Florida is likewise considered of problematical value, while at the New Jersey Station the total yields for four years were in favor of the nonirrigated rows.

In a test at the latter station of surface irrigation, subirrigation, and nonirrigation for strawberries, the early yield was largest on the subirrigated plat and lowest on the surface-irrigated plat. The total yield, however, was 28 per cent greater on the surface-irrigated than on the unirrigated plat and 13 per cent greater than on the subirrigated plat. The late yield was also greatest on the surface-irrigated plat. The total yield on the subirrigated plat was about 12 per cent greater than where no irrigation was given. In these experiments subirrigation was carried out by running a line of horseshoe tile about 1 foot under the surface and turning the water into these.

Where the water supply for irrigation is limited, the Michigan Station recommends the use of subirrigation by placing a line of drain tile below the surface of the soil. If the bed is to be used permanently for gardening purposes, the tile should be far enough beneath the surface of the soil to escape the plow, and where the land requires underdraining they may be placed far enough down to answer this purpose as well. In this case the depth should not be less than 2½ feet and the tile inclined toward the outlet at as slight a fall as possible. When required for subirrigation, the lower end of the tile is simply closed and water turned in and allowed to soak upward through the soil by capillary attraction. If the tiles are required only for the strawberry crop, they should be placed 4 or 5 inches below the reach of the plow or cultivator, and where water only during fruiting time is needed the tiles need be placed scarcely below the surface of the soil. Water should be allowed to enter the tile only as fast as it soaks through the joints. A 3-inch tile is considered most satisfactory. In narrow beds a single line of tile along the center is considered sufficient, but the best results are secured if the water is not required to spread more than 6 or 8 feet each way.

A summary of the results of all the experiments at the stations throughout the country would seem to show that in most of the

Northern States, where the cost of applying the water is not too great, irrigation of strawberries is of great value in insuring a full crop of fruit each season. The water should be applied at about the fruiting time. It should be applied in furrows and allowed to slowly flow down them rather than by flooding.

THE FARMER'S FRUIT GARDEN.[a]

"No farm, no matter what special branch of agriculture forms its main purpose, is complete without its family orchard," says A. V. Stubenrauch, of the Illinois Experiment Station, and yet by far the larger proportion of the farms of the country are not adequately provided for in this respect. The principal reason for this, as given by Mr. Stubenrauch, is that "too often the family orchard is viewed from a commercial standpoint—that is to say, natural difficulties which would render a commercial orchard impossible are looked upon as unsurmountable for the family orchard as well. This is wholly an erroneous point of view. Special practices which would be impossible and impracticable in a commercial orchard are not only possible but profitable in the family place." Such an orchard may not be profitable from a purely pecuniary standpoint, but as a means of increasing the variety, attractiveness, and healthfulness of the diet it has a value which is none the less important because it can not be computed in dollars and cents. Careful attention, however, to details of culture, management, etc., is necessary to success. Among the more important matters to which special attention must be given are thorough and frequent cultivation to conserve soil moisture in time of drought and to cause regular and uniform ripening of the wood before the fall frosts, the selection of hardy varieties in regions of severe winters, and the selection of a location for planting which has good air drainage, in order to safeguard as much as possible against late spring frosts. With the more delicate fruits "laying down" and covering may be found necessary in severe winters.

In laying out and selecting the trees for the home plantation two ideas should be kept in view: (1) The area should not be larger than is actually necessary, and it should be arranged so as to allow most convenience in working—that is, the rows should be made as long as possible. (2) The trees should be the best—the best are always the cheapest, at any price, for this purpose—and should consist of those varieties not only adapted to the locality and the purpose of the grower, but they should be selected to furnish a fairly continuous supply of fruits, both for table and culinary uses. The kinds of trees suitable for the home garden will have to be governed by the locality and the individual tastes of the grower.

The diagram (fig. 2) suggests a plan of a fruit garden of 1 acre, and "shows how great a range of fruits can be secured even on so small

[a] Compiled from Illinois Sta. Circ. 40.

an area. Individual tastes vary, and some may not care to have all the kinds of fruit mentioned, preferring rather to have more of some favorite ones. By a judicious selection of varieties and by giving good

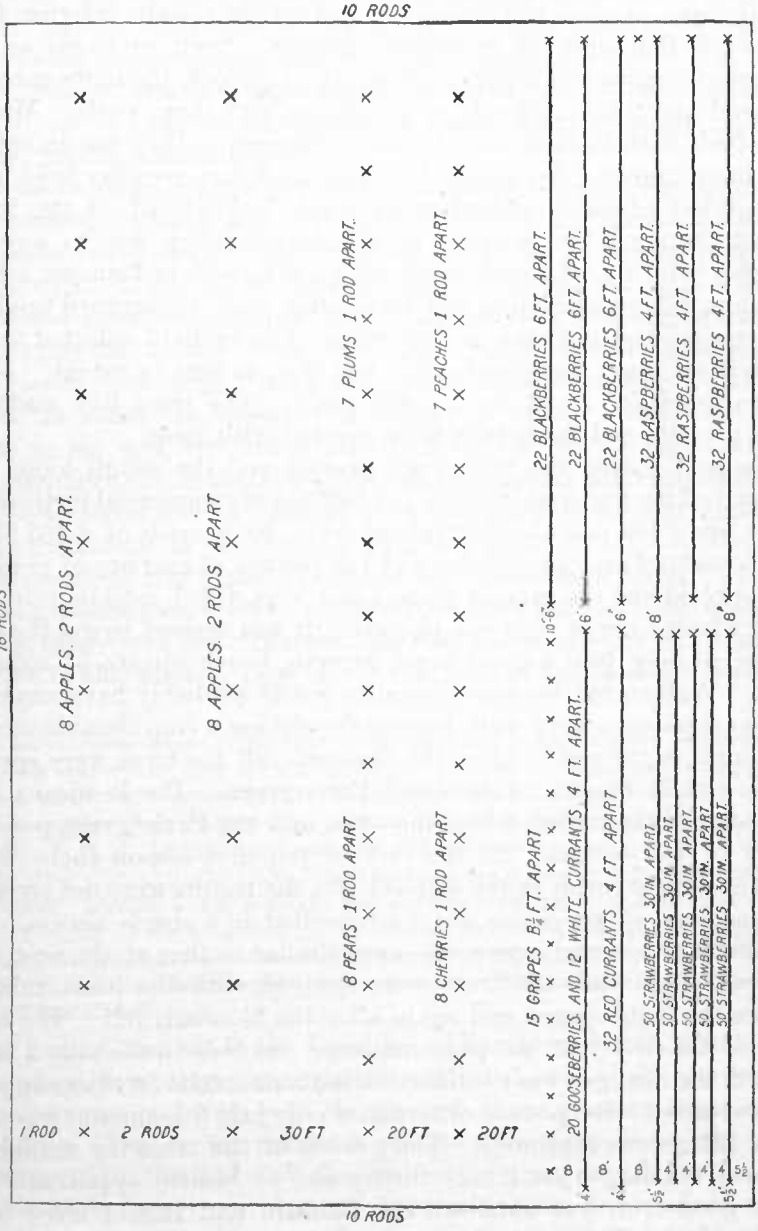

FIG. 2.—Plan of a farmer's fruit garden.

care, it is calculated that an acre laid out as suggested in the diagram should yield an adequate supply of fruit for both the table and for 'putting up' to satisfy the demands of even the largest family."

IMPROVING AND CULTIVATING ORCHARDS.[a]

Neglected orchards are common everywhere. This is especially true of the "home orchard." Many of these orchards, if they bear at all, have become soil-exhausted and produce only inferior fruit, and even that only in occasional seasons. Such orchards are the homes of worms and disease, and serve to restock the more carefully sprayed and tilled orchards of neighbors with these pests. Marketable fruit from them is almost wholly unknown. They are an eyesore and unprofitable. An orchard of this kind has recently been made the subject of an investigation by Prof. F. W. Card, of the Rhode Island Station. The purpose of this investigation was to ascertain whether with the ordinary means within the reach of farmers, such as pruning, tillage, spraying, and fertilizing, such an orchard could be rejuvenated and put on a paying basis. The orchard selected for the experiment was a home orchard of less than an acre in extent. It had been planted for about twenty-five years. The trees had made but little growth, and the trunks were covered with moss.

The first season the trees were pruned and the rough loose bark scraped off the limbs and trunks. A half ton of commercial fertilizers—made up of 125 pounds of nitrate of soda, 100 pounds of dried blood, 650 pounds of acid phosphate, and 125 pounds of muriate of potash—was applied and the ground plowed and kept tilled until midsummer, after which a cover crop was planted. It was desired to get the trees started at once into a good wood growth, hence nitrate of soda was used. Well-rotted barnyard manure would probably have answered the same purpose very well, besides furnishing a considerable amount of humus to the soil. After the blossoms fell the trees were sprayed twice with Bordeaux mixture and Paris green. The Bordeaux mixture cleared the limbs of hanging moss and the Paris green poisoned many of the worms. At the end of the first season there was a marked improvement in the orchard, yet the results were not striking. The neglect of years can not be remedied in a single season. The treatment the second season was very similar to that of the first. To prevent apple scab the trees were sprayed with Bordeaux mixture before the buds opened and again after the blossoms fell. The cover crop of the first year was peas and oats. As these made only a small growth the nitrogen was continued in the commercial fertilizer applied, but instead of 1,000 pounds of fertilizer only half this amount was used. Good tillage was continued. The growth of the trees the second season was not large, yet it was thrifty and of healthy appearance and some good fruit was obtained, the Baldwin and Russet trees being well loaded. The following season, with only a part of the trees

[a] Compiled from Rhode Island Sta. Bul. 83; Missouri Sta. Bul. 49; North Dakota Sta. Bul. 49.

bearing, about $80 worth of fine fruit was obtained. Many of the trees in the orchard were early sorts. Of the fruit sold $50 worth came from the Russet and Greening trees.

During the years the experiment was being carried on the orchard did not receive all the care it needed and was frequently neglected. Nevertheless, the results obtained clearly indicate that these old, neglected, moss-grown, and unprofitable orchards can in many cases be brought up to a thrifty condition and made to pay by spraying, fertilizing, pruning, and tillage.

Of course there are some orchards so located that tillage is out of the question. This is the case where orchards are planted on steep hillsides or rocky lands. In such cases the orchards may be pastured with sheep or hogs. If the grass is kept short less moisture will be evaporated from the ground than if allowed to grow, and the stock will destroy the wormy fruit that falls. Some growers also report good results from letting the grass grow and then mowing it and letting it lie about the trees. "It insures a winter mulch and adds humus to the soil, but draws heavily upon the soil moisture during early summer. It is, therefore, not strange that its advocates thus far seem to be those who are dealing with a wet soil or a rainy climate." Where cultivation is possible it should be given.

The results of five years' careful work in cultivating orchards at the Missouri Station show that the cultivated trees made a more uniform growth than trees not cultivated and were less affected by drought. Relative to this matter, Prof. J. C. Whitten, of the Missouri Station, says:

> The unfavorable effects of drought on uncultivated trees are more apparent the succeeding season than they are during the dry year itself. A marked falling off in height growth and a generally devitalized condition of the trees may be looked for in uncultivated orchards for a year or two following an excessive autumn drought. * * * During a dry summer and autumn the orchard soil should be kept in good tilth until the crop of fruit and the wood growth are mature or until rains come. During a wet summer and autumn cultivation should cease early enough (August 1) for the growth to be checked and the wood ripened for winter. Failure of the wood to mature in autumn may be as often due to ceasing cultivation too early as it is to continuing cultivation too late. This is particularly true when trees are loaded with fruit.

The general custom in the Eastern and Southern States, where rain is abundant, is to keep the orchards cultivated until about the middle of the summer and then seed the ground down to some leguminous cover crop. One of the purposes of this cover crop is to evaporate moisture from the soil and thus cause the trees to properly ripen their wood before winter comes. Late cultivation or abundant moisture tends to a late sappy growth of wood that is likely to winterkill. In the dry portions of the Northwest, however, as Prof. C. B. Waldron, of the North Dakota Station, has shown, the cause of winter-

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killing of fruit trees is "due to the drying up of the twigs, so that in spring there is not enough moisture left in the plant to renew the life processes." Professor Waldron recommends, therefore, that orchards in that region be planted in deep soil, naturally mellow and moist, and cultivated from the beginning to the end of the season, in order to retain as much moisture in the soil as possible. To further prevent the evaporation of the moisture from the ground in winter, it is recommended that a light layer of straw or similar material be spread on the ground about the first of November. "This covering prevents the escape of moisture, as the drying winds can not come in contact with the soil, and also the escape of heat, thus delaying freezing for a considerable time, and shortening the period in which the plant is losing moisture without means of supplying the loss." The application of this mulch has been found of the greatest importance in the Northwest, "saving whole plantations in regions where unprotected trees were practically all killed."

SOME TROPICAL AND SUBTROPICAL FRUITS.[a]

The supply of tropical and subtropical fruits in our markets is constantly increasing. More attention is being given every year to the growing of such fruits in the subtropical areas of the United States (Florida, California, etc.), and the supply will no doubt be added to by the tropical fruit products from our recently acquired island possessions.[b] Among the fruits of this character which are finding their way into our markets in increased quantities, or are likely to be introduced, are pomelos, peen-to peaches, alligator pears, roselle or Jamaica sorrel, and Surinam cherry, all of which have been studied to some extent by some of the experiment stations.

POMELO, OR GRAPE FRUIT.

The pomelo, or grape fruit, belongs botanically to the citrus family along with the lemon and orange. The fruit most common in market is about double the size of an orange and of a lighter yellow color. It is valued chiefly as a breakfast fruit and is eaten with or without sugar, in the same manner as oranges. Marmalade is also made from it. The fruit has a bitter acid pulp and juice that to some tastes is very palatable and refreshing. According to analyses reported by the California Station, the juice contains 2 to 2.7 per cent of citric acid and 6.7 to 9.5 per cent of sugar. Lemons contain 6 to 10 per cent of citric acid and 2.5 to 3.6 per cent of sugar. It is thus seen that the pomelo more nearly approaches oranges in the amount of sugar and acid it contains than lemons.

[a] Compiled from Florida Sta. Buls. 58 and 62; Maine Sta. Bul. 75, Rpt. 1901, p. 109.

[b] For a fuller discussion of some of the fruits of the tropical islands of the United States, see Yearbook of the Department, 1901, p. 353.

The pomelo has lately been made the subject of a bulletin by H. H. Hume, of the Florida Station. According to Professor Hume, the oldest name for the fruit and the one commonly used by horticulturists is pomelo. Commercially, however, the fruit is more generally known as grape fruit. This name is thought to have originated from the fact that the fruit grows in clusters like grapes. Another name sometimes used for the fruit is shaddock. This term, however, is more properly applied to very large pyriform or necked varieties, that are seldom seen in market. These large varieties often weigh 15 pounds or more and to American tastes are of inferior quality.

The pomelo has become commercially important only during the last fifteen or twenty years. The supply in this country comes chiefly from Florida, though California and Jamaica furnish some. The fruit grows like the orange, but is slightly less hardy than the sweet orange. As a stock for oranges and lemons the California Station states that it is rapidly becoming a favorite in southern California. The tree grows upward of 30 feet high and is slightly thorny. The mature leaves are medium sized, ovate, and of a dark-green color. The flowers are large, white, sweet scented, and borne in clusters. From 3 to 18 fruits mature in each cluster. These have a rounded form 3 to 4 inches in diameter. The seeds are usually very numerous, except in a few varieties. Marsh Seedless is a good variety, containing few or no seeds. Analyses by the Florida Station show the percentage of pulp of six varieties to vary from 65.16 to 74.72, and of seed from 3 to 3.45. The same station is authority for the statement that a pomelo tree yielding 800 pounds of fruit removes from the soil 0.4 of a pound of phosphoric acid, 1.9 pounds of potash, and 0.88 of a pound of nitrogen. To replace this material would require 2.85 pounds of acid phosphate, 3.8 pounds of high grade sulphate of potash, and 5.86 pounds of nitrate of soda, or practically 12½ pounds of commercial fertilizers per tree. This amount makes no allowance for the wood growth of the tree, nor for leaching of fertilizing matter from the soil.

As regards the use of commercial fertilizers, Professor Hume says:

> The experience of most growers points to the use of chemical fertilizers alone for all citrus trees. The grove fruits more heavily, a better quality of fruit is obtained, and the trees are certainly in a healthier condition. Where large amounts of organic fertilizers are used, die-back will almost surely affect the trees, and "ammoniated" [a] fruit or fruit containing a large amount of rag and of poor shipping and keeping quality is the result. * * * Fertilizers should be applied at least twice a year—just before or at the time of the commencement of growth and again in summer, about the month of July. During the winter the roots of citrus trees in some parts of the State continue growth, and it would appear advisable in those parts to make a third application in the fall. If nitrate of soda be used as a source of nitrogen it is best to apply it in three separate dressings, in March, May, and July, and the phosphatic and potash fertilizers twice, as recommended above.

[a] A term frequently applied to fruit showing evidence of die-back.

PEEN-TO PEACHES.

According to H. H. Hume, in a bulletin from the Florida Station, the Peen-to peach belongs to a group of peaches that is essentially adapted to subtropical conditions. The group is limited in its adaptations in this country to the States of Florida, Louisiana, Mississippi, Alabama, and the coast regions of Texas. It seems especially suited to Florida conditions, and is therefore of unusual value to that State, since the varieties of peaches which flourish in orchards farther north are nearly always failures when grown in Florida. The successful culture of Peen-to peaches in Florida promises to that State a control of the early peach market and successful competition with other States in the late peach market.

The Peen-to peach was first grown in the South by P. J. Berckmans, of Augusta, Ga., in 1869, from seed obtained from Australia. The

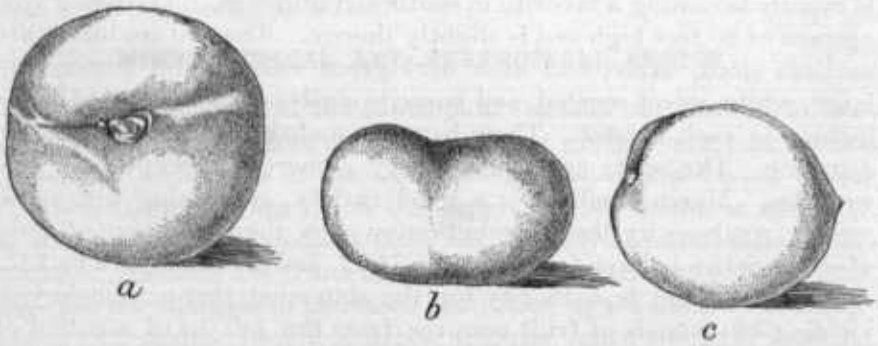

FIG. 3.—Peen-to peaches: *a* and *b*, end and side views of original seedling Peen-to (flat); *c*, side view of another variety (not flattened).

seedling variety obtained was named "Peen-to," and proved of value in southern Florida. All succeeding varieties of this group have originated, according to Mr. Hume, in Florida.

The characteristics of this group (fig. 3) of peaches are thus described by Professor Hume:

> The trees are vigorous, upright in habit, prolific, and well covered with foliage. After fruiting for a number of years the heads become more open and spreading. The leaves are long, narrow, pointed, finely serrated, and with reniform glands at the base. The flowers are large and pink and are produced in great abundance. The fruit with the exception of that produced by the Peen-to and one or two others, is roundish in outline, occasionally blunt pointed. The flavor of those varieties which more closely resemble the parent Peen-to have a decidedly or slightly noyau flavor. In other varieties this flavor is entirely lacking, and it may be acid, subacid, or sweet. The skin is easily removed and the stone may be either free or cling. For the most part they are well colored and of good appearance. The ripening period of the varieties of this group (known at present) extends from April to the middle of July or a little later, though by far the greater number of varieties mature their fruit by July 1.

Some twenty-two or twenty-three varieties of this group have been listed, but a much less number is now in cultivation, many of the earlier sorts being superseded by better later sorts. The varieties Angel and Waldo have given good satisfaction when grown in the southern part of the State, and other varieties, such as Bidwell Early, Bidwell Late, Dorothy N., Jewel, Maggie, Peen-to, and Suber are recommended for planting. In the northern part of the State, Angel, Bidwell Late, Jewel, and Waldo are the most successful varieties grown. Angel and Waldo are considered the most reliable and can be depended upon to give satisfaction. Hall and Rival are both varieties of very fine quality and are recommended for testing in different parts of the State. For the coast region of Texas, Angel, Jewel, and Waldo are recommended.

ALLIGATOR PEAR, ROSELLE, AND SURINAM CHERRY.

Woods and Merrill at the Maine Station recently studied the chemical composition of three rather uncommon fruits which are now grown in Florida and southern California, namely, alligator pear or avocado, roselle, and Surinam cherry, which were furnished them, with descriptions, by the Division of Pomology of this Department. Several years ago the Florida Station reported successful tests on the cultivation of the avocado. The California Station has reported similar tests with the roselle, and has discussed its uses. In their report Woods and Merrill summarized data regarding the nature and uses of these three fruits in effect as follows:

The alligator pear, also known as aguacate, avocado, midshipman's butter, etc. (fig. 4), is the fruit of *Persea gratissima*, a tree native to tropical America, but now widely grown throughout tropical countries.[a] The principal commercial supply in the markets of the United States comes from Jamaica, though there is a considerable and increasing production of this fruit in southern Florida, both on the mainland and the Keys. Small quantities are also grown in the milder regions of southern California. The West Indian type, which is the only one found in the markets of eastern United States, yields a fruit about the size of the largest pears. The varieties differ considerably in form, and range from deep purple to light green in color. Generally speaking, they are not unlike a medium-sized eggplant fruit in form and appearance. The portion eaten is a pulp which surrounds a single large seed (fig. 5). In texture the pulp is soft and somewhat like butter, and is perhaps most commonly used for salad making.

The Mexican type of alligator pear, which is now being tested in California and Florida, is a smaller tree and yields a much smaller fruit. It is, however, reported to endure several degrees of frost, whereas the West Indian type is injured by a temperature of 32° F.

[a] See also U. S. Dept. Agr. Yearbook 1901, p. 354.

The roselle, or Jamaica sorrel, is the fruit of *Hibiscus sabdariffa*, a widely distributed tropical plant, which yields the roselle fiber of commerce. As grown in Florida and California it is an herbaceous annual. The plants are grown from seed in spring, and require a long season free from frost to mature. Under favorable conditions

FIG. 4.—Alligator pear.

they produce a very heavy, continuous crop of blossoms in the latter part of the summer and autumn. The fruits, which somewhat resemble okra or gumbo in form, though they are much shorter in proportion to their size, are a dark, magenta red in color and are used for making jellies and preserves, which are of a beautiful red color and

have a flavor suggesting that of the cranberry. The thick, juicy, dark-red calyxes are the only portions used, and these are at their best soon after the petals fall. If the harvest is long delayed, the enlarging ovary forms too large a proportion of the product and lessens its value by detracting from the flavor of the jelly or preserves. Roselle jelly is now on the market, though it is not very common.

The Surinam cherry, sometimes called pitanga, is the fruit of a tropical shrub, native to Brazil and other tropical regions of South America. This shrub, which attains a height of about 20 feet, is grown to a limited extent in southern Florida and southern California. The fruit is about the size of an ordinary cherry, is roundish oblate in form, ribbed, bright red in color, and of a sharp but pleasant acid flavor. It is somewhat used for domestic jelly making, but the product has not yet attained commercial importance, at least in the United States.

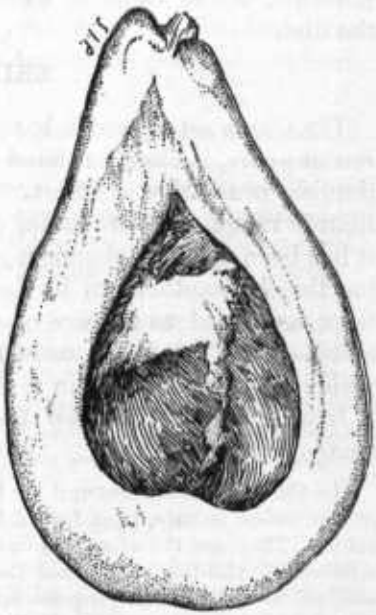

FIG. 5.—Section of alligator pear, showing pulp and seed.

According to Woods and Merrill, the average weight of the avocadoes analyzed was about three-fourths pound each. The edible portion or pulp constituted on an average 71 per cent, the seed 20 per cent, and the skin 9 per cent of the entire fruit. On an average the roselle was made up of about equal proportions of pods and calyx. The edible portion of the Surinam cherry constituted some 83 per cent of the entire fruit, and the stems and stones together some 17 per cent.

The average composition of these fruits is as follows:

Composition of alligator pear, roselle, and Surinam cherry.

	Water.	Protein.	Fat.	Carbohydrates.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Alligator pear (edible portion)	81.1	1.0	10.2	6.8	0.9
Surinam cherry	85.0	.4	.....	[a]13.9	.7
Roselle:					
Calyx	86.5	2.1	.3	10.3	.8
Pod	84.0	1.7	1.0	12.2	1.1
Extract from calyx	91.2	.9	.....	[b]7.2	.7
Extract from pods	93.7	1.5	.....	[c]4.2	.7

[a] Including 10 per cent invert sugar, 10.1 per cent total sugar.
[b] Including 1.6 per cent sugar.
[c] Including 1 per cent sugar.

The Surinam cherry and roselle do not differ materially in chemical composition from more common fruits. The total quantity of nutritive material is small in proportion to the bulk, while the proportion of water (juice) is large. The alligator pear is very different from ordinary fruits in composition, since it contains a high percentage of fat. In this respect it suggests the olive, although it resembles it in no other particular. These fruits are all generally regarded as palatable and are of value in adding to the variety and attractiveness of the diet.

CHINA ASTERS.[a]

The China aster, which has come into prominence in comparatively recent years, is closely related to the chrysanthemum, and, as its name implies, is a native of China. It was originally single flowered and of limited range of color—blue, violet, and white—but under cultivation it has been made to assume a great variety of forms and colors, rivaling the chrysanthemum in these respects, although the aster has not been developed to the size of the larger varieties of chrysanthemums and has not yet been made to show the brilliant shades of yellow which are so prominent in certain of the varieties of the latter flower.

In a bulletin of the New York Cornell Station, L. H. Bailey states that—

> The China asters are amongst the best of all the annual garden flowers. They are of the easiest culture, most free of bloom, and comprise a multitude of forms and colors. They are therefore admirably adapted to profuse and generous effects in schemes of planting. They are also worthy of wide attention because they are adapted to many of the purposes for which chrysanthemums are grown, and they can be raised to perfection wholly without the use of glass. They attain their best in the decline of the season, from late August till frost, at a time when many of the annuals and the greater part of the perennials are spent and gone. No garden flowers carry such a profusion of bloom and color down to the very closing in of winter. The aster border still had blooms when the snows fell in November, and when even the wild golden-rods had waned and died.

The China aster is an annual and especially effective in borders. It grows well in almost any soil, but prefers a rich, moderately moist, but well-drained loam. It responds generously to liberal fertilizing. Recently there has been a quite general and widespread failure in successfully growing the China aster, owing to various diseases and insect pests. Mr. R. E. Smith, of the Massachusetts Station, has been studying this subject and finds among the more important troubles of asters a stem-rot disease or wilt, which is characterized by a wilting and final dying of affected plants, accompanied by a discoloration and rotting of the stem just at the surface of the ground; a yellow disease, which appears as a spindling yellow growth of the branches and leaves and a peculiar abnormal development of the flowers; and root lice,

[a] Compiled from New York Cornell Sta. Bul. 90, and Massachusetts Sta. Bul. 79.

which cause the plant to stop growth and finally wilt and die. In such cases the roots are found to be covered with masses of small, bluish-colored plant lice.

The stem rot or wilt, although first showing itself at any time during the plant's growth, appears to be contracted only in the seed bed or pricking-out flats. Both this disease and the root lice may be avoided by proper methods of cultivation. For the yellow disease no treatment is known. None of these troubles can be remedied after they have once appeared.

Based on the results of his work, Mr. Smith gives directions for growing asters, applicable more especially to regions north of southern Pennsylvania, as follows:

Start your own plants. Seed planted as late as June 1 will give an abundance of bloom before frost. Procure seed directly from a reliable seedsman. It costs no more and is much more liable to be fresh and true to name. Sow the seed in the open ground at any time after the ground gets into good condition, in good soil where asters have never grown before. Fall sowing out of doors may also be practiced. For very early flowering sow in cold frames or in the greenhouse, but this, especially the latter, is much more liable to produce stem rot.

Avoid at all times the use of soil where asters have grown before, especially where the stem rot or root lice have occurred. Prepare the permanent bed by working in a liberal dressing of barnyard manure during the previous fall and a light application of any good commercial fertilizer in the spring. If this is not practicable, remember that as a general principle the richer the soil the better will be your asters. Plant if possible in moderately moist soil. This will give better growth and less trouble from grubworms.

As to varieties of asters to grow, Mr. Smith says:

Asters may be classed into early, mid-season, and late, coming into bloom ordinarily about July 20, August 15, and September 1, but varying, of course, with the time of planting. The Queen of the Market, in various colors, is the standard early variety, together with the similar Queen of Spring, Queen of the Earlies, etc. The recently introduced Tom Thumb Comet or Poodle is also worthy. Of the mid-season the Victoria, Peony Flowered Perfection, and Giant Comet are best known, but by no means include all the best kinds. The new California Branching Comet is especially striking, and many others might be mentioned. Of the late varieties Semple Branching stands preeminent as one of the finest of asters, especially for commercial purposes. The pink Mary J. Semple is considered by many the finest of all asters. It is with difficulty that such a list as this is brought to an end, on account of the many beautiful kinds left unmentioned. The dwarf varieties are numerous and odd, but of no great value for cutting.

A METHOD OF PRESERVING SWEET POTATOES.[a]

A recent bulletin of the South Carolina Station calls attention to the fact that while sweet potatoes may be produced in abundance at small cost and furnish a cheap, nutritious, and palatable food, not only for man, but for domestic animals, they have fallen far short of the full measure of success as a market crop because (1) they are too bulky to pay for extended transportation, and (2) they can not stand rough handling and exposure to freezing weather.

[a] Compiled from South Carolina Sta. Bul. 71.

The station therefore undertook to find a method by which the potatoes might be dried, with an improvement of the keeping quality and no loss of edible quality. After numerous experiments it believes that these results may be obtained by boiling the potatoes in an open kettle and drying in a fruit evaporator. The method followed at the station was as follows:

By means of a derrick used in the cannery several bushels of green potatoes were lowered in an iron basket into a large boiler in which the water was heated by steam. To secure uniform cooking the roots should be nearly of the same size Those weighing from 1 to 2 pounds required one hour for thorough cooking. Six to eight hours were required for evaporating them at a temperature of 150° F. An ordinary laborer peeled and sliced 1 bushel per hour.

The evaporated product, it is claimed, "will keep for an indefinite time and bear transportation to any part of the world at any season." It contained "moisture, 3.42 per cent; crude ash, 2.48 per cent; crude protein, 5.06 per cent; crude fat, 0.80 per cent; crude fiber, 2.08 per cent, and nitrogen-free extract, 86.16 per cent. To prevent hardening of the product it should be packed in close boxes as soon as practicable after removal from the hot room."

To prepare the product for table use "soak the slices in warm water for an hour and prepare as dressed or candied potatoes. The desiccated potatoes may also be used as are the fresh roots for puddings or custards." For the latter purpose they may be quickly prepared by adding a small amount of warm water and boiling; not more than fifteen minutes will usually be required.

THE FOOD VALUE OF BEANS.[a]

Since earliest times lentils, beans, peas, and other legumes have been common articles of diet. Except for analytical studies very few investigations have been made with a view to determining their nutritive value as compared with other foods, although their importance as articles of diet is quite generally appreciated.

Dried beans are perhaps the legume most often used in this country. Baked beans and bean soup are very commonly eaten in America, and boiled beans, seasoned in various ways, are equally common in Europe. On an average American dried beans, such as are ordinarily used for baking, contain 22.5 per cent protein, 1.8 per cent fat, 59.6 per cent carbohydrates, and 3.5 per cent ash, in addition to 12.6 per cent water. Of the total carbohydrates, crude fiber constitutes 4.4 per cent. Dried beans, on an average, have a fuel value of 1,600 calories per pound.

Prof. Harry Snyder, of the Minnesota Experiment Station, has recently studied the digestibility of beans, the comparative composi-

[a] Compiled from Minnesota Sta. Bul. 74.

tion of raw and cooked beans, and the possible losses in nitrogenous material when beans are soaked and parboiled in water containing a little baking soda to remove the skins before baking, and related topics.

In the digestion experiments baked beans formed a considerable part of the diet of healthy men who were engaged in fairly severe muscular work. The beans had been soaked in soda and water to remove the skins and were baked in the usual way, butter being added. The composition of the raw beans was practically the same as the average figures given above. The cooked beans contained much more water than the raw, the amount being about 70 per cent. The fat content of the baked beans was also much greater, on account of the butter added, averaging from 3 to 10 per cent. When eaten with bread and milk, it was found that on an average 90.91 per cent of the dry matter, 80.22 per cent of the protein, 79.82 per cent of the fat, and 96.19 per cent of the carbohydrates of the baked beans was digested. When the beans were eaten with a diet furnishing considerably more fat, somewhat higher values were obtained. Generally speaking, these figures are greater than those obtained by a German investigator, Prausnitz, for boiled beans, his values being 81.7 per cent for dry matter and 69.7 per cent for protein. In the German experiments the beans used were cooked in such a way that they retained their shape. If they had been more thoroughly cooked to a pulp or had been mashed, it is probable that the digestibility would have been increased. In Professor Snyder's experiments the carbohydrates were found to be more digestible than any of the other nutrients. The protein was most variable in digestibility, ranging in the different tests from 72.26 to 86.81 per cent.

Considering the test as a whole, it will be seen that the beans were quite thoroughly digested. They are often considered by popular writers to be indigestible, or, more properly speaking, to be difficult of digestion. Concerning this point Professor Snyder states that individuals differ in regard to their ability to digest beans—

> but when properly combined with other foods, they can not be considered indigestible. Beans are, however, slow of digestion and require more intestinal work than many other foods, but when properly combined so that they form a portion of a ration, the work of digestion is more evenly distributed than when they are used alone and in large amounts. In using beans in the dietary, they are frequently eaten in excessive quantities at irregular intervals, rather than in reasonable amounts, combined with other foods, as a regular part of the ration.

In preparing beans for the table, soda is often employed to soften the skins so that they can be readily removed. In the experiments at the Minnesota Station a half teaspoonful (3 grams) of baking soda dissolved in 2 quarts of water was used to a pound of beans. When the beans were parboiled before baking, some two-thirds of the water

and 84 per cent of the soda were absorbed. (See fig. 6.) The soda retained had probably entered into chemical combination with the proteid material of the beans. Only 0.66 per cent of the total nitrogen of the legumes was extracted by the water used for parboiling them, so this loss of nitrogenous material is unimportant. The skins removed by parboiling constitute about 6.5 per cent of the total dry matter of the beans. As shown by analysis, bean skins contain a relatively small amount of protein and a fairly high percentage of crude fiber. Crude fiber is not well digested by man, and the removal of a considerable portion of it is, therefore, no disadvantage. "The fiber lessens the digestibility of the beans by preventing the solvent action of the digestive fluids. The treatment with soda and the removal of the

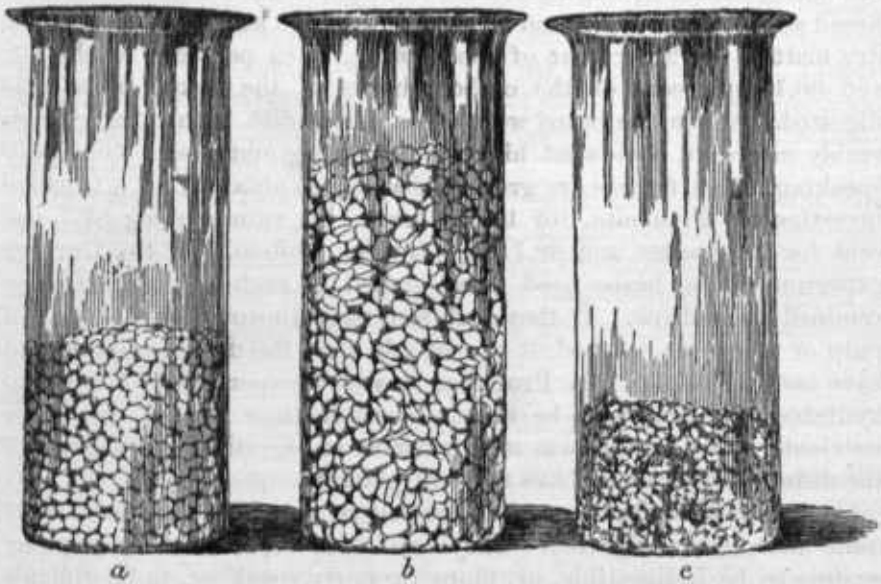

FIG. 6.—Cooked and uncooked beans: *a*, raw beans; *b*, beans after parboiling, skins removed, showing increase in volume due to water absorbed; *c*, moist bean skins removed from *a*.

skins changed the chemical and physical composition of the beans so that they were more completely and readily digested." A small amount of the germ adhered to the skins and was removed with them. In Professor Snyder's opinion, the germ and skin are the parts of the bean which are the most fermentable and produce sulphureted gaseous products during digestion.

The digestibility of the skins which were removed, as well as that of the beans baked with and without parboiling, was tested with ferment solutions. It was found that the treatment with soda and water had a favorable effect upon the digestibility and food value of the beans, as it enabled the digestive ferments to act with more readiness upon the protein—in other words, the beans thus treated were more quickly

digested. According to the author, "It is a matter of common observation that when beans are properly prepared with a small amount of soda and salt there is less difficulty from the formation of gas in the intestines during digestion."

Discussing the cost of beans as compared with other foods and their importance in the diet, Professor Snyder concludes that beans at ordinary prices are among the cheapest foods for supplying protein. A pound of beans costing 5 cents contains about one-fifth of a pound of digestible protein and somewhat less than three-fifths of a pound of digestible carbohydrates, mainly in the form of starch. In the experiments reported, over a pound of baked beans was consumed per day by men engaged part of the time in active outdoor work. It is believed, however, that not more than 4 ounces of uncooked beans or 6 ounces of baked beans should be consumed in the daily ration.

While beans are a valuable food, there are certain limits beyond which they can not be used to advantage in the dietary. The nutrients in beans are different in character from the same class of nutrients in cereals and other vegetable foods and are not as readily digested as those of many of the cereals. Hence beans are suitable for persons engaged in active outdoor work, rather than for those of sedentary habits of life. However, beans, when properly cooked, need not be entirely excluded from the dietary of those of sedentary habits, though they should not form as large a part of the ration as in the case of the active workingmen leading outdoor lives.

Though the amount of protein in beans is large, they contain only a small amount of fat, and hence the addition of fat, either by salt pork or butter, in preparing for the table is reasonable, since, in addition to improving the flavor, it makes a better-balanced article of diet.

TANKAGE, OR MEAT MEAL, FOR PIGS.[a]

In view of the increasing use of tankage as a food for pigs and the beneficial results reported by feeders as attending this use, the Indiana Station has carried out experiments which show that, "as a feeding material for pigs, tankage offers certain advantages. It contains a high percentage of protein and an amount of phosphoric acid that materially excels that found in any grain or by-product of mills. The phosphoric acid for pigs is useful in building up bone structure, an important feature with our pigs of to-day, while the protein has a value universally recognized by feeders." These experiments also "strongly emphasize the weakness of using corn meal as a single ration in feeding growing, fattening pigs, and indicates the great value of adding a food rich in protein [such as tankage] to the corn, thus producing a better-balanced ration and securing more desirable results in both health and growth."

[a] Compiled from Indiana Sta. Bul. 90 and Iowa Sta. Bul. 65.

The Iowa Station has also reported experiments with pigs which indicate that in fattening pigs a ration containing more protein and ash than a pure corn ration gives better results than the latter. In these experiments a ration consisting of 5 parts of corn to 1 of tankage or beef meal, and containing much larger percentages of ash and protein than one consisting of corn alone, gave from 7 to 34 per cent greater net profits than corn alone.

The results reported strikingly demonstrate the value of tankage and similar animal products as food for pigs and indicate that a trial of this material is worthy of the attention of swine raisers generally, especially those so situated that they can readily obtain it. Reports from various sources indicate that the use not only of tankage but also of dried blood as feed for all kinds of farm animals is increasing. In addition to being a nutritious food, dried blood has been found by the Kansas Station to be an excellent remedy for scours in calves.

REMEDIES FOR FLEAS.[a]

The subject of household pests has been very fully treated in publications of the Division of Entomology of this Department, and the work of the Division has been supplemented by some interesting experiments by several of the stations along the same line. Especially valuable results have recently been obtained in experiments with remedies for fleas.

At times fleas, especially the dog and cat flea, become one of the most troublesome of household enemies. Numerous remedies have been recommended for ridding houses and animal pets of these pests, but these remedies have not proved effective under all circumstances. The Division of Entomology recommends thorough sweeping and cleaning of floors and walls, the disuse of permanent carpets and mattings and their replacement with rugs, which are to be removed and beaten at frequent intervals. It is also recommended by this Division that infested carpets and other such material be dusted with pyrethrum powder or sprinkled with benzine, and that this substance be also applied to floors and infested rooms. Failing in these measures, the removal of carpets and thorough scrubbing with hot soapsuds are recommended by the Division.

In some experiments made in Scotland by R. S. MacDougall it was found desirable to cleanse all dog kennels with lime wash, to wash the dogs and cats with soapsuds, and then sprinkle them thoroughly with pyrethrum powder. The use of creolinated water in a 10 per cent solution was also found very effective in ridding houses of fleas and in destroying these insects upon dogs. In some parts of Mexico, accord-

[a] Compiled from U. S. Dept. Agr., Division of Entomology Bul. 4, n. ser.; Vermont Sta. Rpt. 1894, p. 119; Michigan Sta. Bul. 160; New Hampshire Sta. Bul. 94; Trans. Highland and Agr. Soc. Scotland, 5. ser., 11 (1899), pp. 162–164.

ing to MacDougall, brooms are made of *Asclepias curassivica*, a kind of milkweed, and walls and floors of infested houses are swept with these brooms. The odor of this plant when thus utilized has been found to act as a deterrent in checking the spread of the flea nuisance in houses.

At the Vermont Station considerable success was had in sprinkling infested animals and kennels with kerosene emulsion, but this remedy is not applicable in households on account of the disagreeable odor and other effects of kerosene. At the Michigan Station pyrethrum gave excellent results in ridding houses of fleas. This remedy, however, has not always proved beneficial and in some instances was apparently without any effect.

In experiments at the New Hampshire Station it was found that creolin was the most satisfactory remedy. This may be used in a diluted form as a disinfectant, deodorant, insecticide, and repellent. It was found that a 3 per cent solution was strong enough for ordinary purposes. Infested dogs and cats may be thoroughly washed with the mixture, which may be made slightly weaker for cats on account of the greater sensitiveness of the fur of this animal. The animals may also be dipped in the solution. Commercial creolin may be purchased at drug stores for about 25 cents per pint. A 3 per cent mixture with water may be made by adding 4 teaspoonfuls of creolin to a quart of water or 4 tablespoonfuls to a gallon. A 2 per cent solution is obtained by adding 2 teaspoonfuls to the quart or 2 tablespoonfuls to the gallon of water. When thoroughly shaken the mixture is ready for use. The mixture may be applied to the animal with the hands or a brush, or, as already suggested, the animal may be submerged in the solution. The latter process should be prolonged for about five minutes, and the animal requires no further care or treatment after the application. This treatment not only destroys the fleas but serves as a deodorizer.

In treating floors it is recommended that all unnecessary material be removed; the cracks and crevices should be scrubbed with a 5 per cent solution of creolin. The bedding of animal pets infested with fleas should be thoroughly saturated from time to time with a 5 per cent solution of creolin.

Two other remedies which are quite effective against fleas have been recommended with some reservation, but these remedies are perhaps too dangerous for general use in households. Reference is had to fumigation with bisulphid of carbon and hydrocyanic acid.

The above-mentioned remedies include nearly all the direct remedies which have been found effective in destroying fleas. In combating this insect, however, it should always be remembered, as the Division of Entomology of the Department points out, that the infestation of houses is due to the presence of flea-infested dogs or cats, which are allowed to occupy some portion of the house during a part or all of

the time. Fleas normally live as parasites upon the animals which they infest, or upon man, but eggs which are laid by the parasitic adult insects may fall upon the floor or the carpets of houses and after hatching may live for an indefinite period upon the material which naturally accumulates under carpets and in the cracks of floors. In ridding a house of fleas attention should therefore be directed first to treatment of the dogs or cats from which infestation arises. This treatment, if done in a thorough manner, will rid the animal pets of fleas and will prevent the reinfestation of the household after a thorough application of insecticide methods, as discussed above, has been given to the infested premises.

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